

## ASSESSING ENGINEERING MAINTENANCE PERSONNEL'S PERCEPTION OF PREVENTIVE MAINTENANCE EFFECTIVENESS

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### ABSTRACT

Preventive maintenance (PM) plays a critical role in enhancing operational efficiency and minimizing equipment downtime in various industries. This research paper assesses the perceptions of maintenance personnel regarding the effectiveness of preventive maintenance strategies using a Likert scale survey. By collecting and analyzing responses from maintenance staff across different sectors, the study aims to identify key factors influencing their perceptions of PM effectiveness such as cost reduction, reliability improvement, downtime reduction and training and support of engineering maintenance staff. The findings reveal significantly positive insights into the relationship between maintenance practices and personnel perceptions, overall satisfaction of 72.54% as it ultimately contributes to the optimization of PM strategies.

**Keywords:** Preventive maintenance (PM), Perceptions, Operational cost, Likert scale, Assessment, Staff

### 1. INTRODUCTION

Preventive maintenance (PM) is a proactive approach designed to maintain equipment functionality and prevent unexpected failures through regular inspections, servicing, and adjustments. The importance of PM in industrial settings is underscored by its ability to enhance machine reliability, extend equipment lifespan, and reduce operational costs [6,9,15]. However, the effectiveness of PM can vary significantly based on execution quality and personnel engagement. While much research has focused on the technical aspects of PM, there is limited understanding of how maintenance personnel perceive its effectiveness. This lack of insight can hinder the implementation of effective maintenance strategies and impact overall operational performance. It is essential to assess these perceptions to identify potential areas for improvement and ensure that PM programs are aligned with the needs and expectations of maintenance staff.

This study aims to assess maintenance personnel's perceptions of preventive maintenance effectiveness through a Likert scale survey[14]. The objectives include identifying key factors influencing these perceptions and providing actionable insights to enhance PM practices.

### 2. LITERATURE REVIEW

Preventive maintenance (PM) is crucial for minimizing equipment failures and optimizing operational performance. According to [21], PM not only helps in maintaining equipment reliability but also contributes to safety and compliance in industrial environments. Furthermore, Preventive maintenance (PM) is essential for maintaining the operational integrity of equipment in various industries. PM activities, which include scheduled inspections, servicing, and replacements, aim to prevent unexpected failures and prolong the lifespan of machinery [15]. Studies have shown that effective PM practices can lead to substantial cost savings, reduction in unplanned downtime and increased productivity. [4]. According to [21] and [11], organizations that implement robust PM programs often experience reduced equipment downtime and lower repair costs, thus enhancing overall operational efficiency.

The role of maintenance personnel is vital in the successful implementation of PM strategies. Their skills, knowledge, and attitudes toward maintenance practices significantly influence the effectiveness of these strategies. Research by [7] indicated that personnel engagement and satisfaction are critical components of effective maintenance operations. Understanding how maintenance staff perceive PM can help organizations design better training and support systems. The perceptions of maintenance personnel regarding PM effectiveness are critical in determining the success of maintenance strategies. Research by [7] highlighted that positive personnel perceptions are associated with increased engagement and adherence to maintenance protocols. When maintenance staff believe that PM is effective, they are more likely to actively participate in and prioritize these activities. Conversely, negative perceptions can lead to resistance to PM practices, ultimately undermining their effectiveness [5,20].

Several factors can influence maintenance personnel's perceptions of PM effectiveness. One key factor is the level of training and support provided to maintenance staff. According to O'Brien, adequate training not only enhances the technical skills of personnel but also fosters a sense of confidence in executing PM tasks. This confidence translates into a more positive perception of PM effectiveness. [18,3].

Another influential factor is the availability of resources, including tools, technology, and time allocated for PM activities. Research has indicated that personnel who feel well-equipped and supported in their roles are more likely to view PM positively [2]. Lack of resources, on the other hand, can lead to frustration and decreased morale, negatively impacting perceptions of PM effectiveness [12]. The Likert scale is a widely used tool for measuring attitudes, perceptions, and opinions [14]. By using a structured survey with a Likert scale, researchers can quantify subjective assessments, making it possible to analyze patterns and trends in perceptions of PM effectiveness. The Likert scale is a prevalent tool for measuring attitudes and perceptions across various fields, including maintenance and management research. Its structured approach allows researchers to quantify subjective experiences and analyze trends in perceptions [6]. Studies employing Likert scales have successfully highlighted correlations between personnel attitudes and maintenance outcomes, reinforcing the importance of understanding these perceptions [19].

Using a Likert scale allows researchers to capture nuanced views of PM effectiveness, enabling a more comprehensive assessment that combines quantitative data with qualitative insights. This approach can reveal the underlying reasons for specific perceptions, offering organizations valuable information for enhancing PM strategies [17,8].

Understanding the human factors involved in maintenance management is essential for optimizing PM effectiveness. The interaction between maintenance personnel and management practices can significantly influence the success of PM programs. Research indicates that fostering a culture of open communication and collaboration within maintenance teams can enhance personnel engagement and satisfaction [16]. Such a culture encourages maintenance staff to share their experiences and perceptions, leading to continuous improvement in PM practices. Additionally, recognizing the psychological and emotional factors that affect maintenance personnel can provide further insights into their perceptions. For instance, studies have shown that job satisfaction, recognition, and a sense of ownership over maintenance tasks can enhance positive perceptions of PM [1,13,17]. Therefore, addressing these human factors is crucial for organizations aiming to improve their PM strategies.

Despite the growing body of literature on preventive maintenance, there remains a notable gap in research specifically focused on assessing maintenance personnel's perceptions. Much of the existing research emphasizes quantitative performance metrics, often overlooking the subjective experiences of maintenance staff. This gap limits the understanding of how perceptions influence the implementation and success of PM practices. Furthermore, few studies have integrated qualitative aspects with quantitative assessments to provide a holistic view of PM effectiveness. Factors such as training, resources, and organizational culture significantly influence these perceptions. Utilizing a Likert scale to assess these perceptions can provide valuable insights for organizations seeking to enhance their PM practices. Addressing these gaps is essential for developing maintenance strategies that are both technically sound and aligned with the experiences and needs of personnel involved in PM activities.

### 3. METHODOLOGY

#### 3.1 Research Design

This study employs a quantitative research design utilizing a Likert scale survey to assess the perceptions of maintenance personnel regarding PM effectiveness.

#### 3.2 Survey Instrument

A structured survey was developed, consisting of eighteen (18) questions that evaluate various aspects of PM effectiveness, including: Reliability Improvement: Perceived impact of PM on equipment reliability. Cost Reduction: Perceived impact on maintenance and operational costs. Downtime Reduction: Perceived effectiveness in minimizing equipment downtime. Training and Support: Perceived adequacy of training and resources provided for Preventive Maintenance and Overall Satisfaction: General satisfaction with PM practices. The survey used a 5-point Likert scale ranging from "Strongly Disagree" (1) to "Strongly Agree" (5).

#### 3.3 Data Collection

The survey questionnaire was distributed to maintenance personnel across various industries, including manufacturing, energy, and transportation. A total of 300 responses were collected, ensuring a diverse representation of experiences and perspectives.

#### 3.4 Data Analysis

Quantitative data from the Likert scale responses were analyzed using statistical methods, including descriptive statistics and correlation analysis, to identify trends and relationships among the factors assessed.

## 4. RESULTS

### 4.1 Survey Responses

A total of 300 surveys were completed consisting of 210 (70%) of male, 75 (25%) of female and 15 (5%) of respondents who preferred not to disclose their gender as shown in Figure 1.

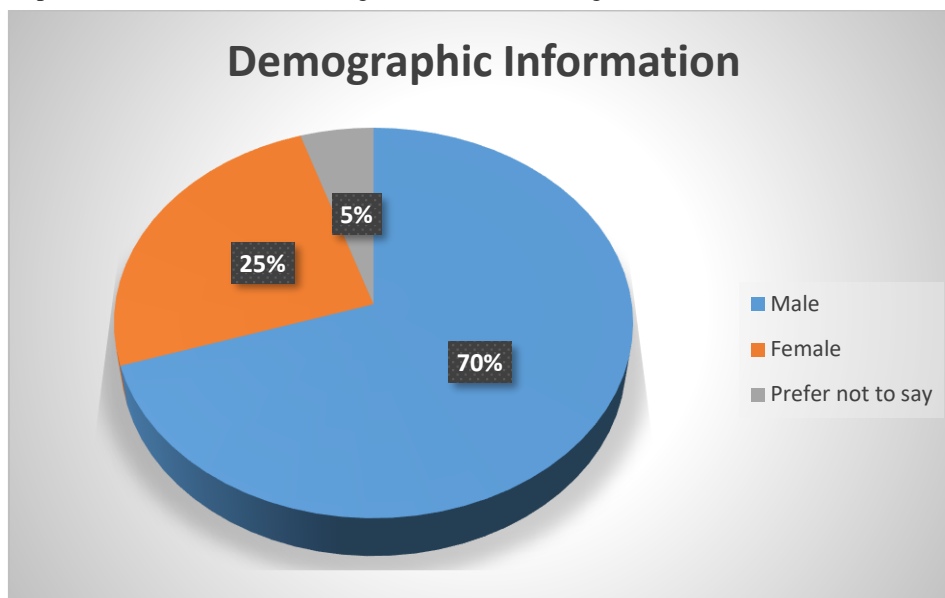


Figure 1. Demographic information of respondents.

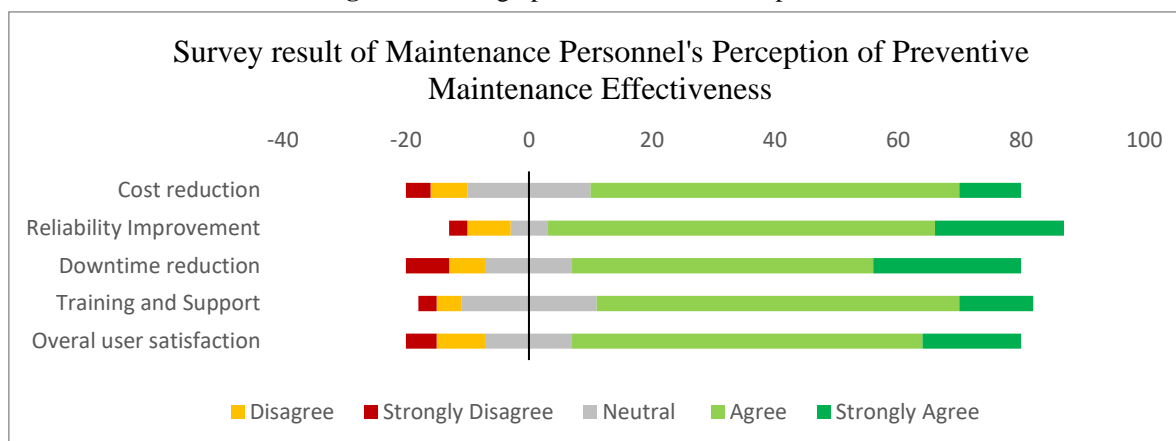


Figure 2. Survey result of personnel perception on preventive maintenance

The following key findings were observed as shown in Figure 2 are: Reliability Improvement: 86.15% of respondents agreed that PM significantly improves equipment reliability. Cost Reduction: 68.53% perceived that PM contributes to lower maintenance costs. Downtime Reduction: 80.11% agreed that PM effectively reduces equipment downtime. Training and Support: 65.12% felt adequately trained and supported in PM practices and Overall Satisfaction: 72.54% expressed satisfaction with current PM strategies.

### 4.2 Correlation Analysis

Correlation analysis revealed a positive relationship between perceived training adequacy and perceptions of PM effectiveness. Specifically, personnel who felt adequately trained agreed more that Preventive Maintenance improves reliability and reduces downtime. Qualitative feedback highlighted several themes, including the importance of effective communication within maintenance teams, the need for continuous training, and the desire for better resource allocation for PM activities. The findings indicate that maintenance personnel generally perceive preventive maintenance as effective in enhancing equipment reliability and reducing downtime. The positive correlations between training adequacy and perceptions of PM effectiveness suggest that investing in training and support can lead to improved outcomes. Organizations should focus on enhancing training programs and ensuring that maintenance personnel feel adequately supported in their roles. By addressing the identified themes and concerns, companies can optimize their PM strategies and ultimately improve operational performance. This study is limited by its reliance on self-reported data, which may be subject to bias. Additionally, the cross-sectional nature of the study limits the ability to assess changes over time.

## 5. CONCLUSION

This research highlights the importance of assessing maintenance personnel's perceptions of preventive maintenance effectiveness relative to cost and downtime reduction, reliability improvement, training and support.. The use of a Likert scale survey provides valuable insights into how maintenance staff view PM strategies, revealing significant areas for improvement as corroborated by [12, 16]. By aligning PM practices with the needs and expectations of personnel, organizations can enhance maintenance effectiveness, leading to improved operational outcomes.

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